Logistics performance of the Thai food industry

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A B S T R A C T

This study focuses on investigating logistics performance of Thai food industry. The study is based on a collection of Thai Industrial Logistics Performance Indicators (ILPI) database. ILPI comprises of 27 indicators, taken from 9 logistics activities with 3 dimensions of interest, i.e., cost, time and reliability. With 355 food companies out of total 1,644 companies in the database, strengths of Thai food industry can be identified. It is found that Thai food industry is good in forecasting, warehousing and transportation. Logistics reliability is generally outstanding from the average of the country. From database, the statistical analysis is also conducted in order to reveal the relationship of each ILPI. The ILPI relationship diagram of Thai food industry is constructed, indicating if there are any significant relations between any ILPI. Finally, paper investigates the performances if the companies' size matters. The paper also discussed the findings with the nature of the food industry and the effect of company size. The information is suggestive if should the industry need improvement or support, and on what activity or dimension.

1. Introduction

Thailand is world's 20th biggest economy. It has GDP of 406.9 billion USD. Whilst transforming to an industrialized country, exporting automobile and electronic products, local economy of Thailand is still based on agricultural chain. Today, food industry is still among the most contributed industries in Thailand, sharing up to 23% of the country's GDP. There are more than 10,000 food factories and companies registered. 99% are reported as Small and Medium Enterprises. The industry involves with more than 1 million labors. This is not included the downstream supply chain which is expected to involve more than 5 million labors in agricultural and fishery sectors. In 2018, Thailand expected to export USD27 billion worth of food to the world. With the strengths of material inputs, skills of labor and standardized process, food industry is promoted by Thai government as "Kitchen to the World" and "Food basket of Asia" (BOI, 2014). Thailand top 5 food exports are rice, sugar, chicken, tuna and shrimp. The production technology of Thai food

industry is today advanced. Ready-to-Eat (RTE), food ingredient, deep sea fishery, food trading and cold chain, beverage and food additives are among 2018 rising stars. Halal, food safety and standard are also in focus by Thai government (BOI, 2014; 2015).

Therefore, the paper aims at investigating Thai food industry logistics performance. The study will be indicative should the industry need improvement or support, and on what activity or dimension.

2. Logistics in Thailand

Logistics is a main driver of the industry competitive advantages (Hallajian and Atf, 2016). Where logistics involves the flow of goods, information and finances between the points of origin to the point of consumption, the efficient logistics management allows the company to fulfil requirement of customers per their preferences (Bowersox et al., 2002; Christopher, 2016; Lambert et al., 1998; Shahbaz et al., 2018).

Today, Thailand is 26th in Ease of Doing Business in 2018 (WBG, 2017). Thailand is also ranked 32th in World Bank's International Logistics Performance Indicators (International LPI) in 2018 (Arvis et al., 2018). However, Thailand's rank has yet been improving significantly since 2007 (Fig. 1).
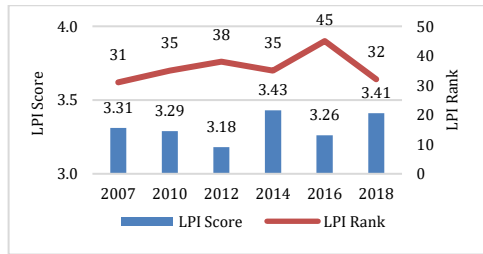
Fig. 1: Thailand's Rank in World Bank's International Logistics Performance Indicators (Arvis et al., 2018; Limcharoen et al., 2017)

The issue is of interest by Thai government as well as the private sectors. There are room of improvement in terms of facilitating and improving logistics and supply chain in order to increase competitive advantage of Thailand. Some issues were approached directly by related government agency, for example, customs and infrastructure. However, some issues belong directly to the private business. From World Bank's LPI findings, suggestions were given in many perspectives including improving logistics performance of the companies (Limcharoen et al., 2017; Ramingwong et al., 2015; Santiteerakul et al., 2018).

Focusing on the company level, Thai food industry are new to logistics management concept. Most of the companies focuses on transportation and warehousing primarily. Because it is the most expensive and highly tangible. However, logistics covers much more disciplines as they all involve (Fawcett and Cooper, 1998; Shapiro, 1992; Leksakul et al., 2015). Many concepts were used to assess the performance of logistics with a variety of concepts, levels and depths (Caplice and Sheffi, 1995; Chow et al., 1994; Mentzer and Konrad, 1991; Tippayawong et al., 2015). For Thai companies, tools and concepts of logistics have been adopted and understood differently due to either experience, product type, customer requirement, size, policy or nationality of firms (Goh and Pinaikul, 1998; Iijima and Sugawara, 2005; Kengpol and Tuominen, 2009; Sopadang et al., 2014). Standing in the middle and being authorized as the official logistics driver and facilitator of Thai industry, the Division of Logistics in Ministry of Industry of Thailand, simplifies the concepts of logistics and introduces a Thailand tailor-made logistics performance measurement tools, called "Industrial Logistics Performance Indicators (ILPI)". The division aims at assessing logistics performance of Thai companies and constructing an ILPI database of Thai industry. It can be a platform for the company to learn and understand basic logistics concepts. For those who are advanced, it can be a reflective guideline for improvement, where the strengths and weaknesses can be identified.

3. Industrial logistics performance indicators (ILPI)

Introduced to Thai industries in 2010, Division of Logistics, has already collected the data of 1,644 companies. The company own assessment data is used for self-improvement (Ramingwong et al., 2015). The analyzed information is also used for government purpose such as supporting, promoting and funding (MOI, 2017; Jangkrajarng et al., 2018).

ILPI is based on 9 logistics activities (MOI, 2017; Grant et al., 2006), i.e., Demand Forecasting and Planning, Customer Service and Support, Logistics Communication and Order Processing, Purchasing and Procurement, Material Handlings and Packaging, Warehousing and Storage, Inventory Management, Transportation and Reversed Logistics. In each activity, indicators in 3 dimensions are applied, i.e., Cost, Time and Reliability. Therefore, ILPI comprises of 27 indicators, shown in Table 1. Each indicator was selected and nominated per suitability of data collection for Thai industry. Each ILPI is clearly defined and the calculation formula is suggested to overcome biasness. For example, ILPI6R-Inventory Accuracy, the indicator is defined as a measure of how closely official inventory records match the physical inventory. It is undoubtful that accuracy of inventory directly affects the company production and customer fulfilment systems (Quarterman, 2006; Meyer, 1990; Wayman, 1995).

Table 1: 27 ILPI: 9 logistics activities x 3 dimensions (MOI, 2017)

Logistics Activities	Dimensions		
	Cost	Time	Reliability
ILPI1 Demand Forecasting and Planning	ILPI1C Forecasting Cost per Sales	ILPI1T Average Forecast Period	ILPI1R Forecast Accuracy Rate
ILPI2 Customer Service and Support	ILPI2C Customer Service Cost per Sales	ILPI2T Average Order Cycle Time	ILPI2R Delivered In-Full and On-Time
ILPI3 Logistics Communicat-ion and Order Processing	ILPI3C Information Processing Cost per Sales	ILPI3T Average Order Processing Cycle Time	ILPI3R Order Accuracy Rate
ILPI4 Purchasing and Procurement	ILPI4C Procurement Cost per Sales	ILPI4T Average Procure-ment Cycle Time	ILPI4R Supplier DIFOT
ILPI5 Material Handlings and Packaging	ILPI5C Damaged Value per Sales	ILPI5T Average Material Handling and Packaging Cycle Time	ILPI5R Damage Rate
ILPI6 Warehousing and Storage	ILPI6C Warehous-ing Cost per Sales	ILPI6T Average Inventory Cycle Time	ILPI6R Inventory Accuracy
ILPI7 Inventory Management	ILPI7C Inventory Carrying Cost per Sales	ILPI7T Average Inventory Day	ILPI7R Inventory Out of Stock Rate
ILPI8 Transportation	ILPI8C Transport-ation Cost per Sales	ILPI8T Average Delivery Cycle Time	ILPI8R Transport-ation DIFOT
ILPI9 Reversed Logistics	ILPI9C Returned Cost per Sales	ILPI9T Average Cycle Time for Customer Return	ILPI9R Rate of Returned Goods

ILPI Website www.thailogisticsbenchmark.com and Manual were developed by Division of Logistics, Ministry of Industry of Thailand (MOI, 2017) in order to educate and allow companies to self-assess their logistics performance (Fig. 2).

When the companies access the website and wish to perform the self-assessment, they are requested to identify and register to the system with basic information such as name, address, industry type, sales volume, etc. Then the website will lead to the self-assessment page. Each page will host ILPI indicator one by one, with its definition and suggested formulas. Once the companies input required field, the page will calculate ILPI and then benchmark their ILPI with the database. Three levels of benchmark are used, i.e., (i) benchmarking with all companies in the database, (ii) benchmarking with companies in the same industry type, and (iii) benchmarking with companies in the same industry type and same size. Therefore, the company can see their performance in any perspectives of interest (Fig. 3) gives example of the automatically generated feedback report that the company will get once complete their assessment. The report simply uses radar and bar charts for visual understanding on the benchmarking (Fig. 3).
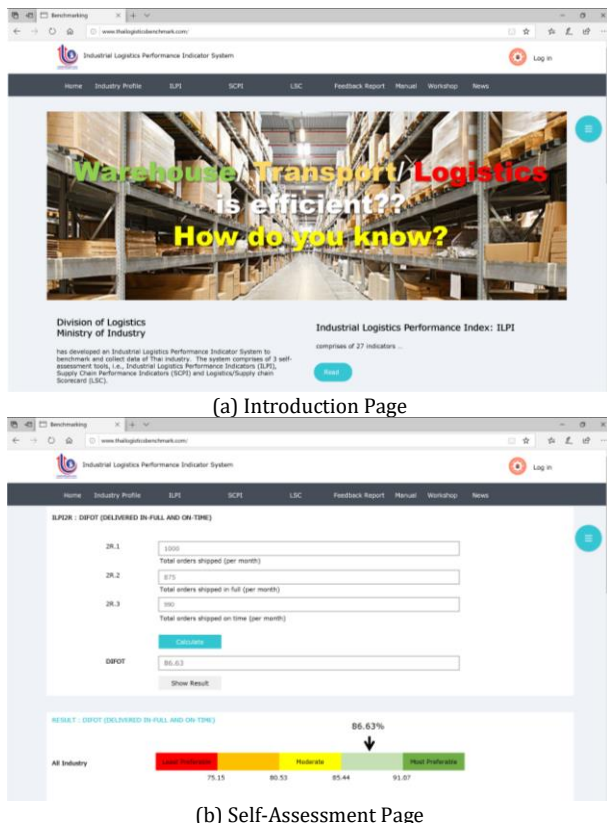

(a) Introduction Page

(b) Self-Assessment Page
Fig. 2: Snapshots of www.thailogisticsbenchmark.com

Here, the company will learn from the feedback report on what are their strengths or weaknesses in comparison to their peers. The feedback report not only provide benchmarking dataset but also gives preliminary suggestion for the company if they wish to improve on their weak area.

4. Result and discussion

The information and data used in this paper is based on the ILPI database of 355 food companies in Thailand with the country average, yielded by total database of 1,644 companies (Jangkrajarng et al., 2018).
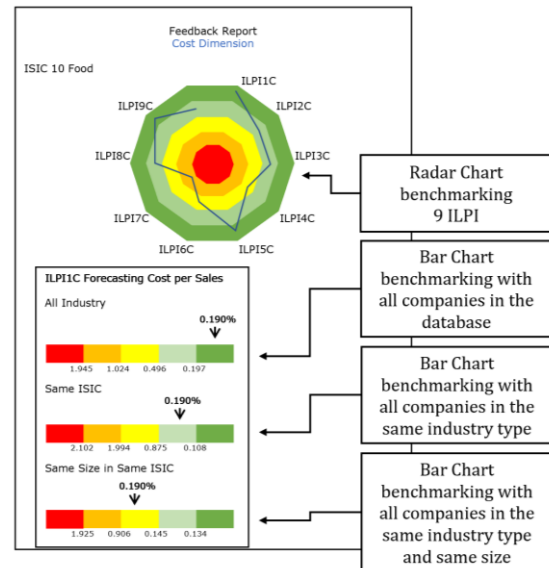

Fig. 3: Example of feedback report

The results presentation is divided into 3 topics and objectives as: (1) overall performance of Thai food industry in relationship with country average, (2) relationship of ILPI, should any ILPI affect others statistically and (3) size inspection, if any company size outperforms others and why. The following sections present results and discuss the issue.

4.1. Overall performance

ILPI figures shown in Fig. 4 are taken from the average of food industry and the average of the country. The figures shows that Thai food industry has slightly advancement in cost performance. They have low forecasting cost, low information processing cost, low damage cost, low warehouse cost, low inventory carrying cost, low transportation cost and low return cost. However, customer service cost and procurement cost are higher than the average. In terms of time, Thai food industry are short in most activity, i.e., order cycle time, order processing time, procurement cycle time, material handling and packaging cycle time, inventory cycle time and day and cycle time for return. In term of accuracy, Thai food industry is weak in order accuracy rate and damage rate.

4.2. Relationship of ILPI

In order to investigate the relationship of 27 ILPI, the Model Fitting with Regression Technique and Analysis of Variance (ANOVA) are used, should any performance affect to each other statistically (Hair et

al., 1998). The relationship of interest is if the p-value of any 2 ILPI is less than 0.05. Fig. 5 summarizes key finding on these analysis as ILPI Relationship Diagram for Thai food industry.
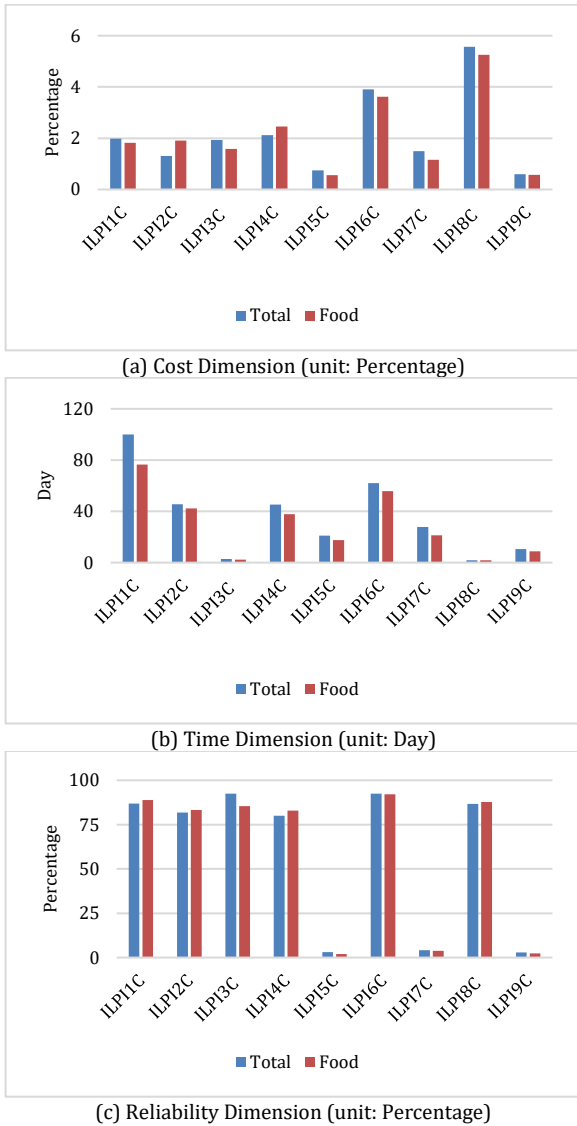

(a) Cost Dimension (unit: Percentage)

(b) Time Dimension (unit: Day)

(c) Reliability Dimension (unit: Percentage)
Fig. 4: ILPI of food industry and Thai average

Numbers on arrows connecting ILPI nodes denotes coefficient of the regression equation. For example, 0.079-arrow connects ILPI3R with ILPI8R means ILPI3R should influence on ILPI8R at the rate of 0.079 (Eq. 1).

$$ILPI3R = 82.87 + 0.079 * ILPI8R \qquad (1)$$

This relationship indicates the potential if any company wishes to improve any performance, they can either focuses on the activity directly or improves other related performance. For example, Eq. 1 indicates if the company can improve ILPI8R (Transportation DIFOT), the Order Accuracy Rate (ILPI3R) tends to improve at the rate of 0.079. Moreover, Average Inventory Cycle Time (ILPI6T), Transportation Cost per Sales (ILPI8C), Average Material Handling and Packaging Cycle Time (ILPI5T) can also be influenced by the improvement of ILPI8R.

4.3. Size inspection

Focusing on sizing of the factory, should it be advantageous to the logistics performance. Fig. 6 then summarizes gap of food industry in terms of size "Small (S)", "Medium (M)" and "Large (L)", categorized by annual sales of less than THB100 million, THB100-600 million and more than THB600 million, respectively. The distance to average percentages of indicators shown in Fig. 6 are from linear normalization. Country average of food industry is noted as 0%. Here, the higher, positive percentages indicate a better logistics performance. The lower, negative percentage, on the other hand, indicates the unsatisfiable.
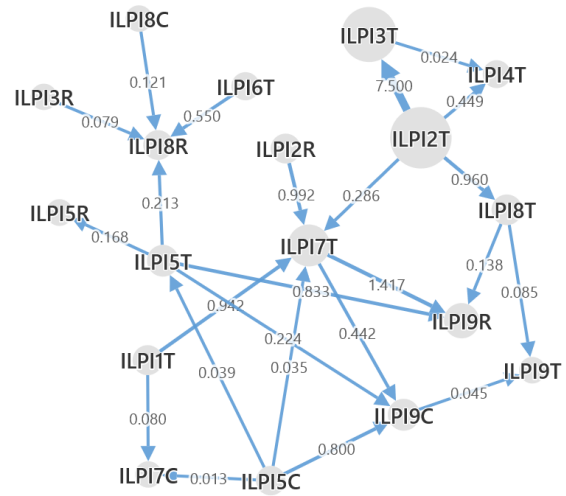

Fig. 5: Relationship diagram of ILPI of Thai food industry

Here, it can be seen that, in general, small food companies tends to perform better than the medium and large. In terms of cost, the small companies have smaller expenses in forecasting, inventory, transportation and reverse logistics, however, with a high customer service and support cost. Yet it is very small compared to those advantageous ones, mentioned above. The large companies also comparably good in cost management of logistics communication, material handling and packaging and warehouse. The medium companies are found worst in customer service and reverse logistics.

In terms of time, food industry is very quick. The small food companies tend to be very fast in customer response, communication, procurement, inventory and reverse logistics. The medium companies are also advanced in managing procurement and inventory cycle time. The large companies are only outstanding here in managing their inventory day.

In terms of reliability, food industry is as logistically reliable as the country average. In general, small companies tend to have better reliability and accuracy in logistics.

To discuss the findings, we must understand the nature of Thai food products and companies (Goss et al., 2000). Thai food products are normally large in

volume, but cheap. They are mostly short life, perishable and fragile. For Thai food companies, if categorized small, are mostly very small (BOI, 2014; 2015; NFI, 2016).

(a) Cost Dimension

(b) Time Dimension

(c) Reliability Dimension
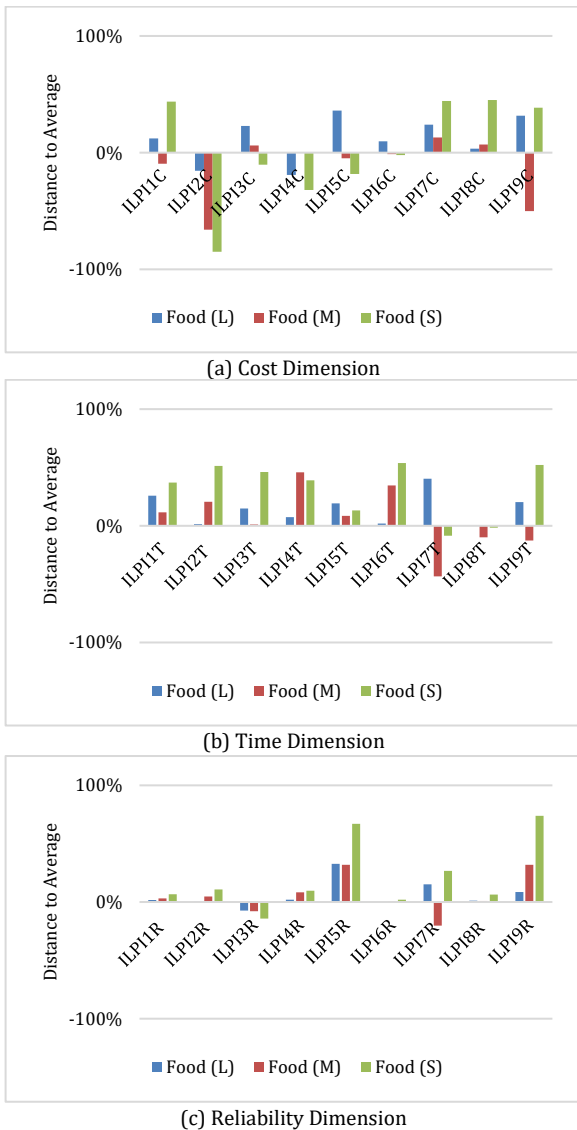
Fig. 6: Normalized ILPI of food industry – Distance to Thai average in percentage

With limited workforces, the business functions are mostly not separated. Logistics functions and productions are normally crossed-function. The small food companies are born and died so quick. Therefore, the competitive advantages are either their product innovation or their customer understanding. If they survive, most products are likely to be new and developed to meet customer sophistication. Therefore, it can be seen that they are good in time and customer responsiveness. And as the company organization is small, they tend to manage their logistics activities in a "small fish" way.

On the other hands, the large companies are mostly mass production, multi-national and export-based (BOI, 2015; Kritchanchai, 2004). Therefore, it is normal that they are slow, lengthy and complicated due to high standard and control. However, this results in their strength in communication, manage and control of inventory.

The medium size company has the mixture characteristics of those large and small. As it can be seen that they are not outstanding in most ways, they still perform better than the country average. However, this findings from the study is only suggestive that if they wish to become a larger company, they must improve in many ways to be survive in this competitive supply chain environment.

5. Conclusion

The study focuses on logistics performance of Thai food industry based on the database of Industrial Logistics Performance Indicators (ILPI). Compared to average of Thai industry, the food industry has advancement in cost and time performance. However, it cannot be concluded that food industry is logistically better than other industry.

Further inspection is conducted using Thai food industry database, the statistical analysis is also conducted in order to reveal the significant relationship of each ILPI. Thus, the ILPI relationship diagram of Thai food industry is constructed. This is suggestive if any company wishes to target any area of improvement, they can either invest or improve directly to the issue of interest or indirectly to the related subjects.

Finally, the inspection is conducted in terms of size. It can be found that, in general, small companies tends to perform better than the medium and large in terms of response, communication, procurement, inventory and reverse logistics. Reliability and accuracy are very good. They also manage cost well in forecasting, inventory, transportation and reverse logistics. The large companies also good in managing cost of logistics communication, material handling and packaging and warehouse. They also tend to keep inventory day on good control. The medium size companies are found to be mixed characteristics between the small and large. The findings are suggestive should the industry need improvement or support, and on what activity or dimension.

Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

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